e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(7); 474-478

Original Research Article

An Observational Study of Sociodemographic Characteristics in Aluminium Phosphide Poisoning Cases at SMS Medical College and Hospital

Ramesh Laxman Gothwal[1], Vijeyta Siwach[2], Himanshu Pipliwal[3], N. L. Disania[4], Surya Bhan Kushwaha[5]

[1]Senior Resident, Department of Forensic Medicine & Toxicology, S.M.S. Medical College & Attached Group of Hospitals, Jaipur

[2,3,5]3rd Year P.G. Resident, Department of Forensic Medicine & Toxicology, S.M.S. Medical College & Attached Group of Hospitals, Jaipur

[4]Senior Professor, Department of Forensic Medicine & Toxicology, S.M.S. Medical College & Attached Group of Hospitals, Jaipur

Received: 01-04-2025 / Revised: 15-05-2025 / Accepted: 21-06-2025

Corresponding author: Dr. Surya Bhan Kushwaha

Conflict of interest: Nil

Abstract

Background: Aluminium phosphide (AlP), commonly used as a pesticide is a highly toxic compound frequently implicated in deliberate self-poisoning in developing countries, particularly India. Its easy availability, low cost, and high fatality rate make it a major public health concern.

Aim: To evaluate the sociodemographic characteristics of patients admitted with Aluminium phosphide poisoning at SMS Medical College and Hospital, Jaipur.

Methodology: This observational, hospital-based study was conducted from June 2021 to May 2022 over 59 confirmed cases of Aluminium phosphide poisoning as per history given by patients/relatives and after informed consent admitted in a medical emergency at S.M.S Medical College, Jaipur. Data on age, gender, residence, marital status, education, occupation, socioeconomic background, and intent (suicidal, accidental, or homicidal) were recorded and analyzed using descriptive statistics.

Results and Observation: Out of the total cases studied, the majority were young adults aged 21-30 years were 29 cases (49.15%), with a male predominance 51 (86.4%) cases. Most cases were from rural backgrounds 43 (72.88%) and belonged to lower socioeconomic strata 32 (54.23%). Majority of the cases, 39 (66.10%) belonged to joint family. Suicidal intent was noted in 53 (89.83%) cases. The overall mortality in the present study was 47.5% which implies that almost half of the sufferers died.

Conclusion: Aluminum phosphide poisoning is common cause of morbidity and mortality which was observed more in males of active age group and was mostly suicidal in nature. This indicates that consumption of this poison is a concern for public health. Early intervention, mental health support, and strict regulation on pesticide availability are essential to reduce incidence and mortality.

Keywords: Aluminium phosphide, poisoning, sociodemographic profile, suicide, rural health, pesticide toxicity, SMS Medical College.

Introduction

Poisoning is a significant contributor to global morbidity and mortality, with developing countries bearing the greatest burden due to the widespread availability of toxic substances and limited access to emergency medical care. In India, poisoning cases are a common presentation in emergency departments and contribute significantly to hospital admissions and deaths. Among the various agents, Aluminium phosphide (AlP) has emerged as one of the most fatal and commonly used poisons, particularly in North India where agriculture dominates the economy. [1] Aluminium phosphide is a solid fumigant used for grain preservation, available in tablet form, and widely sold without stringent regulatory control. On ingestion, it reacts with water and hydrochloric acid in the stomach to release phosphine gas, a potent mitochondrial poison that inhibits cytochrome c oxidase and disrupts cellular respiration, leading to multi-organ failure and death [2,3]. Its fatal dose is low, and no specific antidote exists, making early supportive care critical [4]. The mortality rate of AlP

poisoning ranges between 30% to 70%, as reported in various studies, and depends on factors such as ingested dose, delay in treatment, and patient comorbidities [5,6]. Despite its high lethality, it continues to be one of the most commonly used substances in suicidal poisoning due to its low cost, easy availability, and lack of awareness among the public regarding its toxicity [7].

Studies have shown that most victims of AlP poisoning are young adults aged between 20–40 years, predominantly males, and usually from rural and agricultural backgrounds [8,9]. These individuals often belong to lower socioeconomic classes and have limited education, which contributes to poor awareness about the dangers of pesticide use. Psychosocial factors like unemployment, debt, domestic issues, and academic failure are frequently observed as contributing reasons for suicidal ingestion [10].

Research also suggests a strong correlation between poor mental health support in rural areas and rising trends in pesticide poisoning. Additionally, the easy accessibility of AlP in households and farms further aggravates the issue [11]. According to a WHO report, pesticide self-poisoning accounts for up to one-third of suicides globally, with India being one of the most affected countries due to the widespread use of agrochemicals [12].

This observational study, conducted at SMS Medical College and Hospital, Jaipur, seeks to analyze the sociodemographic characteristics of patients presenting with Aluminium phosphide poisoning. By identifying common trends in age, sex, occupation, marital status, education, socioeconomic status, and intent, this study aims to provide actionable insights that may help in policy formulation, poison control measures, mental health intervention, and public awareness campaigns.

Aim: To evaluate the sociodemographic characteristics of patients admitted with Aluminium phosphide poisoning at SMS Medical College and Hospital, Jaipur.

Methodology: The present observational, descriptive study was conducted at the Emergency Department of SMS Medical College and Hospital, Jaipur, with the objective of analyzing the sociodemographic characteristics of patients admitted with acute Aluminium phosphide poisoning. Sample size of 59 cases were included in the study using a convenience sampling method, based on a clear history of AlP ingestion provided by the patient or their relatives and the initial clinical diagnosis made in the emergency department.

The data collected included information on age, sex, marital status, education level, occupation, socioeconomic status, and residential background (urban or rural), along with the intent of poisoning (whether suicidal, accidental, or homicidal). Data were compiled in Microsoft Excel and analyzed using SPSS software version 20.0. Prior ethical approval was obtained from the Institutional Ethics Committee, and confidentiality of patient information was strictly maintained throughout the study.

Result & Observation

Table 1: Age & sex wise distribution of Cases (N=59)

Age Group (Years)	Gender		Total
	Male	Female	
10-19	3	3	6 (10.17%)
20-29	26	3	29 (49.15%)
30-39	11	2	13 (22.03%)
40 and above	11	0	11 (18.65%)
TOTAL	**51 (86.4%)**	**8 (13.6%)**	59 (100%)

In this study of 59 Aluminium phosphide poisoning cases, the majority of patients were young adult males aged 20–29 years, accounting for 49.15% of cases. Overall, males constituted 86.4% of the total, while females comprised 13.6%. Other affected age groups included 30–39 years (22.03%), 40 years and above (18.65%), and 10–19 years (10.17%), indicating a clear male predominance and highest incidence in the second decade of life.

Table 2: Religion wise distribution of the cases (N=59)

Religion	Number of cases	Percentage (%)
Hindu	58	98.3
Muslim	1	1.7
Total	59	100

In the present study, the majority of Aluminium phosphide poisoning cases were reported among individuals belonging to the Hindu community, accounting for 58 out of 59 cases (98.3%). Only 1 case (1.7%) was reported

among individuals from the Muslim community, indicating a predominance of Hindu patients in the study population.

Table 3: Domiciliary status wise distribution of cases (N=59)

Residence Status	Number of cases	Percentage (%)
Rural	43	72.48
Urban	16	27.11
Total	**59**	**100**

In the present study, a significant majority of Aluminium phosphide poisoning cases were reported from rural areas, comprising 43 out of 59 cases (72.88%), while only 16 cases (27.11%) were from urban areas. This indicates a clear predominance of poisoning incidents among the rural population.

Table 4: - Educational status wise distribution of cases (N=59)

Educational Status	Number of Cases	Percentage (%)
Illiterate	**5**	**08.4**
Primary	**14**	**23.73**
Secondary	**18**	**30.50**
Degree & Above	**22**	**37.30**
Total	**59**	**100**

In the present study, Aluminium phosphide poisoning cases were most commonly observed among individuals who had education up to degree level or above, accounting for 22 cases (37.30%). This was followed by those with secondary education at 18 cases (30.50%), primary education at 14 cases (23.73%), and illiterate individuals, who constituted only 5 cases (8.4%).

These findings indicate that poisoning was reported across all educational levels, with a higher proportion among those with at least secondary education.

Table 5: Occupational status wise distribution of cases (N=59)

Occupational status	Number of Cases	Percentage (%)
House wife	2	3.38
Self employed	13	22.03
Unemployed	3	5.08
Student	19	32.20
Employed with others	22	37.28
Total	59	100

In the present study, the highest number of Aluminium phosphide poisoning cases were seen among individuals who were employed with others, accounting for 22 cases (37.28%), followed closely by students, who comprised 19 cases (32.20%). Self-employed individuals made up 13 cases (22.03%), while unemployed persons and housewives accounted for 3 cases (5.08%) and 2 cases (3.38%), respectively.

This indicates that working individuals and students were the most affected occupational groups in this study.

Table 6: - Distribution of cases of aluminum phosphide poisoning according to their sex, domicile, family type, outcome (survival/fatality) and manner of poisoning (N=59)

Mode of Poisoning & gender correlation	**Suicidal**	**Male**	**47**	**53 (89.83%)**
		Female	**6**	
	Accidental	**Male**	**4**	**6 (10.16%)**
		Female	**2**	
Mode of Poisoning & domicile correlation	**Suicidal**	**Rural**	**38**	**53 (89.83%)**
		Urban	**15**	
	Suicidal	**Rural**	**5**	**6 (10.16%)**
		Urban	**1**	
Mode of Poisoning & family type correlation	**Suicidal**	**Joint**	**34**	**53 (89.83%)**
		Nuclear	**18**	
	Accidental	**Joint**	**5**	**6 (10.16%)**
		Nuclear	**1**	
Distribution of sex according	**Discharged**	**Male**	**29**	**51 (86.4%)**

to their outcome		**Female**	**2**	
	Expired	**Male**	**22**	**8 (13.55%)**
		Female	**6**	
Mode of poisoning & their outcome	**Suicidal**	**Discharged**	**29**	**53 (89.83%)**
		Expired	**24**	
	Accidental	**Discharged**	**2**	**6 (10.16%)**
		Expired	**4**	

In this study, suicidal poisoning was the predominant mode, observed in 89.83% of cases, with a strong male predominance (47 males vs. 6 females). Accidental poisoning accounted for 10.16%**,** also more common in males. Suicidal cases were mainly reported from rural areas (38 cases) and among those from joint families (34 cases)**.** Accidental cases were also largely rural (5 out of 6) and from joint families (5 cases).

In terms of outcome, among males, 29 were discharged and 22 expired, while among females, 2 were discharged and 6 expired, indicating a higher female mortality rate. Out of 53 suicidal cases, 29 survived and 24 expired, whereas in accidental poisoning, 4 out of 6 patients died, suggesting a high case fatality rate in both groups, especially accidental cases.

Discussion

This observational study found that aluminium phosphide poisoning most commonly affected young adult males aged 20–29 years, aligning with earlier studies by Chugh SN, et al.(2000) [5] and Singh D, et al.(1996) [7], who also reported a similar age and gender distribution. The predominance of male patients (86.4%) may be linked to their greater exposure to agrochemicals and higher involvement in occupational and psychological stressors. A significant rural predominance (72.88%) was observed, consistent with findings from Shadnia S et al.(2009) [4], who noted a similar pattern due to widespread rural use of AlP for grain storage.

The religious distribution in our study, showing 98.3% Hindus, likely reflects the local population makeup rather than any specific association. Interestingly, most patients had at least secondary-level education, unlike the study by Aggarwal P, et al.(1998) [9], which showed a higher incidence among those with low literacy.

This shift might suggest changing patterns of poisoning across socioeconomic strata. Students and employed individuals were the most affected occupational groups, in agreement with Sinha US et al. (2001) [10], who emphasized the role of academic and work-related stress (5).

Suicidal intent accounted for nearly 90% of cases, similar to findings by Bumbrah GS, et al. (2012) [13], reflecting AlP's easy availability and high lethality. Notably, the mortality rate was higher among females and accidental cases, underscoring the need for faster intervention and preventive awareness. Overall, the findings confirm that Aluminium phosphide poisoning remains a critical public health issue in rural India, warranting regulatory control, mental health support, and targeted public health measures.

Conclusion

The study shows that Aluminium phosphide poisoning remains a major public health concern in rural India, mainly affecting young adult males with suicidal intent. Most cases involved individuals from rural, joint families, indicating social and environmental stress factors. Higher mortality was noted in females and accidental cases. The findings highlight the link between sociodemographic factors and poisoning outcomes, emphasizing the need for early intervention, timely treatment, and preventive measures.

Recommendations of Study

Based on the study, it is recommended to strictly regulate the sale of Aluminium phosphide, especially in rural areas. Public awareness campaigns should be conducted on the dangers and safe handling of toxic substances. Mental health services need to be strengthened, particularly for youth and economically stressed individuals. Rural health centers should be better equipped to manage poisoning cases. Active involvement of local authorities and health workers is essential to identify and support at-risk individuals.

Limitations of Study

This study has some limitations. It was done in a single hospital, so the results may not apply to other areas. The sample size was small and selected by convenience, which may cause bias. It mainly focused on sociodemographic factors and did not examine psychological or economic reasons for poisoning. No lab tests were done to confirm the amount of poison taken. Also, long-term follow-up of survivors was not done.

References

1. Park K. Preventive and Social Medicine. 26th ed. Jabalpur: Banarsidas Bhanot; 2021. p. 389–391.
2. Reddy KSN. The Essentials of Forensic Medicine and Toxicology. 35th ed. Hyderabad: K Suguna Devi; 2022.

3. Proudfoot AT. Aluminium and zinc phosphide poisoning. Clin Toxicol. 2009; 47(2):89–100.
4. Shadnia S, Sasanian G, Allami P, Hosseini A, Ranjbar A, Amini-Shirazi N, et al. A retrospective 7-year study of aluminum phosphide poisoning in Tehran: opportunities for prevention. Hum Exp Toxicol. 2009; 28(4):209–13.
5. Chugh SN, Aggarwal HK, Mahajan SK. Aluminum phosphide poisoning: experience at a tertiary care hospital. J Assoc Physicians India. 2000; 48(9):855–8.
6. Gupta S, Ahlawat SK, Bharti S, Kumar R, Jain S. Aluminum phosphide poisoning: possible role of supportive measures in the absence of specific antidote. Indian J Crit Care Med. 2006; 10(3):123–6.
7. Singh D, Jit I, and Tyagi S. Aluminum phosphide poisoning: a prospective study of 16 cases. Am J Forensic Med Pathol. 1996; 17(3):236–8.
8. Gargi J, Rai H, Chanana A, Rai G, Sharma G, Bagga IJ. Current trends of poisoning—a hospital profile. J Indian Med Assoc. 2006; 104(2):72–3.
9. Aggarwal P, Handa R, Wali JP. Aluminum phosphide poisoning: profile of the fatal cases. J Assoc Physicians India. 1998; 46(4):369–70.
10. Sinha US, Kapoor AK, Agnihotri AK, Srivastava PC. A profile of acute poisoning at a North Indian tertiary care center. J Clin Forensic Med. 2001; 8(4):180–5.
11. Balali-Mood M, Shariati M, Mohammad M, Moshiri M. Mechanisms of aluminum phosphide toxicity and treatment: an update. Arch Ind Hyg Toxicol. 2012; 63(1):61–7.
12. World Health Organization. Preventing suicide: a global imperative. Geneva: WHO; 2014.
13. Bumbrah GS, Krishan K, Kanchan T, Sharma M, Sodhi GS. Phosphide poisoning: a review of literature. Forensic Sci Int. 2012; 214(1–3):1–6.